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June 23, 2000
Serial No. 00-127

Ms. Linda R. Dietz
Remedial Project Manager
United States Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Subject: Comments on Draft Focused Feasibility Study for the Southern Area Alternative at the Metal Bank Site, prepared by CDM Federal and dated May 17, 2000
Metal Bank Superfund Site
Ogden Project 87053-0000

Dear Ms. Dietz:

Ogden Environmental and Energy Services Co., Inc. (Ogden) and Hart Crowser (HC) are submitting these comments on the Draft Focused Feasibility Study (FFS) for the Southern Area Alternative at the Metal Bank Site in Philadelphia, Pennsylvania (prepared by CDM Federal and dated May 17, 2000). These comments are being submitted in accordance with your letter dated May 25, 2000 and on behalf of the Cottman Avenue PRP Group Respondents, hereinafter identified as the "PRP Group Respondents":

Baltimore Gas and Electric Company
Consolidated Edison Company of New York, Inc.
Long Island Lighting Company d/b/a LIPA
Orange and Rockland Utilities
PECO Energy Company
Potomac Electric Power Company
PPL Electric Utilities Corporation
Public Service Electric and Gas Company
Virginia Power Company

It is important to note that although these comments were developed in reviewing the FFS, the decisions made with regard to the selection of the Remedy for the site must consider the entirety of the remedy on the site as a whole. The USEPA should make the decisions with regard to this portion of the Remedy when the other issues are also finalized, including the Explanation of Significant Difference and the Comments on the Preliminary Design.

Please contact John Dobi at (973) 430-8036 or me at (215) 654-1620 with any questions regarding these comments.

Sincerely,
Ogden Environmental and Energy Services Co., Inc.

Philip H. McQuiston

Philip H. McQuiston, P.E.
Project Manager

Attachments

cc: Steven Straight (PADEP)
Craig Olewiler (PADEP)
Cottman Avenue PRP Group Respondents
Steering Committee
Technical Committee
Joseph P. Vitale, P.E. (Earth Tech)
Jeffrey N. Martin, Esq. (Hunton & Williams)
Dan J. Jordanger, Esq. (Hunton & Williams)
John Mattioni, Esq. (Mattioni Ltd.)
Edward Kleppinger (EWK)

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Comments on Focused Feasibility Study
Southern Area Alternatives
Metal Bank Superfund Site

The following comments are presented in the order in which they were developed in the report. The section of the report that prompted the comment is also identified.

Comment	Section
1.	Section 1.1.1, Last paragraph. The last sentence is incorrect. The PRP Group and the Site Owner's Group have presented alternatives for other areas of the site. These alternatives included: 1. Excavation of sediments above 1 ppm only. 2. Elimination of the cofferdam. 3. Sediment excavation using environmental techniques and without dewatering. 4. Optimization of the sheet pile wall to contain riprap. The USEPA has indicated that it has accepted these alternatives and, therefore, they do not need to be included in this Focused Feasibility Study.
2.	Section 1.3, First paragraph. There was no evidence of a rupture of the UST found during the Pre-Design Investigation.
3.	Section 1.4.3, First paragraph, second sentence. An approximately 10-foot layer of organic clay was encountered underlying the site during the Pre-Design Investigation.
4.	Section 2.4. CDM's LNAPL volume calculation of 8,030 gallons is inaccurate for a number of reasons. First, the thickness of LNAPL in the piezometers does not represent the thickness of LNAPL in the surrounding soil. The somewhat adhesive and viscous LNAPL will accumulate in the wells due to surface tension, adhesion to the sides of the small diameter wells, and capillary action. The measured thickness is likely to be significantly greater than the actual thickness. According to Mercer, J.W. and R.M. Cohen, 1990, *A Review of Immiscible Fluids in the Subsurface*, "The LNAPL thickness measured in monitoring wells typically exceeds the LNAPL-saturated formation thickness by a factor of approximately 2 to 10." Applying a factor within this range would greatly reduce the volume of LNAPL calculated to actually be present at the site.

AR001600

Second, CDM's calculations fail to apply a porosity factor for the soil matrix to account for the actual volume of LNAPL that could be present. A porosity factor of 0.35 should be applied to the volume based on Table 4.2, Porosity Ranges for Sediments, in C.W. Fetter's *Applied Hydrogeology* (second edition, Macmillan Publishing Company, New York, 1988). A review of Table 4-2 indicated that 0.35 was the most appropriate porosity to use based on the soil types encountered and confirmed with geotechnical testing at the site.

Third, CDM inaccurately calculated the area using rectangles of estimated dimensions. The attached calculation uses AutoCad 14 to more realistically calculate LNAPL areas surrounding the wells based on the surveyed locations of the wells.

Fourth, assuming that the entire area has the average volume found in the three wells is unrealistic. An accumulation in the area of the wells that tapers with isocons is more realistic.

Fifth, the amount of LNAPL present is not likely to be recoverable LNAPL, but is more likely to be residual, immobile LNAPL. Considering the fact that the LNAPL has been present at the site for in excess of twenty years and an oil collection system was operated in the 1980s, the LNAPL remaining is believed to be residual LNAPL. Residual LNAPL is considered immobile barring a significant hydraulic gradient change. A reference to support this position is Testa, S.M. and M.T. Paczkowski, 1989, *Volume Determination and Recoverability of Free Hydrocarbons. Groundwater Monitoring Review*, 9(1): 120-128, which states: "Recoverable portion of any LNAPL in the subsurface ranges from 20 to 60%; only 20 to 30% of the total release volume is typically recovered."

Finally, Ogden agrees with CDM's calculations that there is no appreciable volume associated with the sheen and no volume should be calculated for the area where a sheen is expected to be present. Furthermore, with the removal of the LNAPL by excavation, the remaining area of sheen would predominantly consist of immobile residual LNAPL. Based on API 4682, June 1999, "Recovery of Petroleum Hydrocarbon Liquids," Ogden attempted to calculate the volume of recoverable oil and determined that the volume of recoverable oil is approximately zero.

Ogden has included three drawings to demonstrate the volume of LNAPL that is likely to exist at the site.

Drawing 1, "Floatable Oil/LNAPL Apparent Volume Calculation," indicates the volume of LNAPL that would be present based on the (erroneous) assumption that the measured thickness in the wells represents the thickness in the surrounding area, and calculates the volume based on AutoCad areas and the anticipated porosity of 35 percent. Drawing 2, "Floatable Oil/LNAPL Actual Volume Calculation," indicates the volume of LNAPL likely to be present when dividing by a factor of 2 for the apparent thickness and accumulation in the wells. Drawing 3, "Recoverable Floatable Oil/LNAPL Volume Calculation," indicates the volume of that LNAPL that is likely to be recoverable is less than 100 gallons of LNAPL. This applies an additional 20 percent factor based on the above reference, which indicates only 20 to 30 percent of the LNAPL is typically able to be recovered. The 20 percent factor is appropriate for the residual oil at this site due to the time since the release and the previous recovery operations. Ogden also has included as Attachment 1 a calculation sheet showing the calculated recoverable oil based on the API document.

5. Section 3.1.1, Second full paragraph.

The LNAPL identified at the site was found to be an adhesive and viscous material that coated and stuck to measuring devices. The LNAPL present today remained after the previous oil collection system reportedly stopped recovering oil and has weathered since that time. This paragraph and the report imply that an oil collection system will actually recover oil from the heterogeneous fill material containing debris. The efficacy of oil collection at this site is unlikely. Basing the Draft Focused Feasibility Study on this premise is unrealistic. After the soil removal required by Alternative 1 is completed, any residual oil that might remain is unlikely to be recoverable.

Based on USEPA 1995, *Light Nonaqueous Phase Liquids, EPA/540/s-95/500,* USEPA Robert S. Kerr Environ. Res. Lab., Ada, OK, "Due to factors such as viscosity, density, relative permeability of the subsurface material to LNAPL flow, and capillary forces, only a portion of the total LNAPL volume present in the saturated zone is considered mobile and can be expected to be recovered via conventional means (pump and treat or skimming)." This supports the position that once the soil is excavated, an oil collection system will be ineffective and unlikely to recover any oil. It is also Ogden's opinion that any residual oil that might remain will be immobile and unrecoverable, and also does not pose a significant threat to the environment due to the immobility.

As stated above in *Volume Determination and Recoverability of Free Hydrocarbons,* "Recoverable portion of any LNAPL in the subsurface ranges from 20 to 60%; only 20 to 30% of the total release volume is typically recovered."

Considering the fact that a previous oil collection system was operated at this site, it is unlikely that even 20 percent of the volume that is present at the site can be recovered by pumping or skimming. Therefore, it is Ogden's opinion that the installation of an oil collection system may be ineffective at recovering LNAPL from the subsurface, especially if it is installed after the soils containing PCBs above 25 ppm, which contain most of the LNAPL, are excavated. Based on the information that is currently known about the LNAPL at the site, installation of an LNAPL collection system may not be justified at this time and will be even more unjustified in the future if the LNAPL excavation alternative is implemented.

6. Section 3.1.3, Page 3-5, Second paragraph.
Excavation to remove soil containing PCBs above 25 ppm and LNAPL is expected to proceed to 1 foot below the low groundwater level, as indicated on sheet C-15 of the Preliminary Design Report, not 3 feet. Excavation to one foot below the groundwater table will remove the contamination which was identified during the Pre-Design Investigation. Excavation to a greater depth would be likely to create problems related to side wall collapse and the quantity of dewatering required to maintain open excavations.

7. Section 3.3.2.3, Second paragraph.
Discussions with carbon manufacturers, including Calgon Corporation, General Carbon Corporation, and CarbonAir, indicate that they have never been involved with the installation of carbon canisters below the groundwater table. It is unclear if the Site Owner's proposed plan is achievable or has ever been successfully utilized. [Documentation should be provided to demonstrate that this passive submerged groundwater treatment system is feasible.]

Filtration that removes fine particulates prior to installation of the carbon is routinely installed to prevent clogging of the carbon canister with fines present in the groundwater. Assuming the hydraulics at the site would provide the required head to allow this system to work, it is unlikely that the carbon would be prevented from constantly fouling. Any geotextile placed around the collection pipe with an apparent opening size small enough to be effective in preventing clogging of the carbon (approximately 10 microns) is likely to clog and increase the head required to operate the system and prevent the system from working at all. All three manufacturers recommended filtration prior to the carbon, and this filtration usually has much greater head requirements than the carbon requiring liquid to be pumped through the carbon/filtration system. The geotextile will also increase the head buildup over time and restrict the passive groundwater treatment system from working.

In addition, tide backflow prevention devices are necessary and not shown. If installed, they will also cause groundwater mounding and are likely to clog as well. The carbon manufacturers also expressed concerns with biological growth in the carbon and the ability to create and inspect a seal below the groundwater table. Additional problems may result from other contaminants in the groundwater, including metals prematurely exhausting the carbon. Because of this, the ability to predict when the carbon will require maintenance.

The manufacturers also expressed acknowledged concerns with low flow channeling through the carbon, the ability to determine when the carbon has been spent, and the ability to service, inspect, and maintain the carbon. Based on these factors, it is unlikely that the proposed groundwater treatment system will allow any water to pass through the sheet pile wall over time and it is likely to mound water behind the wall with flow away from the river or around the sheet pile wall.

It is also possible that the mounding of water behind the sheet pile wall with the impermeable barrier could result in an unacceptable buildup of pressure behind the sheet pile wall, causing the wall to fail. This is particularly likely if the tide gates become blocked or if the carbon system becomes clogged either in the carbon canister or in the groundwater collection piping.

With the 7-foot tidal fluctuation present at the site, the proposed groundwater treatment system may not be able to allow groundwater to leave the site, may not prevent backflow from the river, and may not prevent mounding of groundwater to the point that groundwater flow is not away from the collection system. Based on this assessment, it does not appear that a hydraulic analysis of the site has been performed to demonstrate that this alternative is feasible.

Lastly, we fail to see how a geomembrane can be installed 2 feet below the low groundwater table, which is 5 feet below the cobble and gravel ground surface along the mudflats. Geomembrane cannot be driven through cobbles to this depth.

8. Sections 3.3.1.6 and 3.3.2.6.
The implementability of the oil collection system assumes oil can be collected. The references quoted above provide information that refutes this assumption.

9. Section 3.3.3.1.
The identified LNAPL will be removed by the excavation alternative. While the excavation is open, any LNAPL that is mobile will move towards the excavation. LNAPL that does not migrate is immobile and is likely to consist of, at most, a sheen.

The excavation will be left open for a few weeks through the process of construction. As a result, any significant pockets of LNAPL should be drawn to the depressed groundwater table. If a measurable thickness or 1/8 inch of LNAPL is observed on the sidewall and is entering the excavation in a measurable quantity of greater than 1/16 of an inch, it can and should be excavated. However, it will not be appropriate or practical to proceed with excavation to try to remove a sheen of oil. Excavation of soil to remove a sheen has the potential to result in an unreasonable excavation of a large portion of the site.

Incidentally, it is also not possible to remove a sheen of oil with an oil collection system, so all three alternatives will result in some presence of oil being left at the site. This is typical of remediation and the oil that is left is residual and is considered immobile and does not need to be addressed based on this immobility and the fact that it will degrade over time. The proposed sheet pile wall provides the additional redundant level of protection to address any concern associated with this potential and immobile sheen of LNAPL.

Although the LNAPL present at the site is not directly related to the concentration of PCBs in the soil, excavation of soils that remain at this site and contain less than 25 ppm of PCB is likely to produce a sheen. However, under normal conditions, the LNAPL producing the sheen is likely to remain immobile as discussed above. It is impracticable to excavate a sheen at the Metal Bank Site when soil with up to 25 ppm of PCBs is permitted by the ROD to remain onsite. If the USEPA concludes, in spite of these factors, that a sheen should be excavated, then the containment onsite alternative (without groundwater treatment, which the ROD does not require) should be further evaluated as excavation of the LNAPL layer may become impractical and cost prohibitive.

10. Section 3.3.3.1, Page 3-15, Third paragraph.
The sheet pile wall was intended to facilitate LNAPL collection and prevent erosion. With the LNAPL excavation alternative, the sheet pile wall in the LNAPL area becomes a redundant measure to protect against the potential that some residual remains. There does not appear to be any evidence of significant erosion at the site. The large concrete blocks have been stabilized and trees and other vegetation have further stabilized the bank over the last 20 years. Vegetation is a recognized and effective method of erosion prevention and vegetated strips are a common method of sedimentation and erosion control. Even after Hurricane Floyd, there did not appear to be any surficial erosion at the site. The addition of the soil cover also will be designed with no greater than a 3:1 slope in the transition to the existing bank and will be stabilized with appropriate erosion control fabric. It is our opinion that containing the riprap and the previous LNAPL area will be sufficient and somewhat redundant.

11. Section 3.3.3.1, Page 3-15, Third paragraph.
LNAPL has never been identified in the area of SA-2, and there is no reason to suspect that LNAPL is present. The piezometers were installed to supplement the existing monitoring wells and in accordance with the USEPA-approved Work Plans. During the PDI and under the oversight of CDM, the location of the piezometers were adjusted slightly based on the existence of monitoring wells, such as MW-15 and MW-4A, to try to maintain coverage of the outer perimeter of the site and also to gather a concentration of information in the SA-4 and SA-5 areas, where there was a concern of previous LNAPL, a UST, and more concentrated extensive contamination. It is likely that the PCBs in sediment to the east of the site are not dissipating due to the upriver sheet pile wall that extends out into the river and prevents currents from flowing past this area. There is no evidence of a current or present contribution of PCBs into the river in this area from the site. It is also unclear that the contamination that has

accumulated downstream of the bulkhead is from the Metal Bank Site. There has never been a record of LNAPL in this area and, thus, there was no good reason to install a piezometer in this area.

12. Section 4.4.
Treatment with carbon does not reduce toxicity any more than collection of LNAPL in an accumulation tank does. Carbon transfers contaminants to another media where they later must be disposed in a landfill or treated in some other way.

13. Section ~~4.3~~ 4.5, Second paragraph.
The excavation in Alternative 3 is virtually identical to the excavation in Alternative 1. Alternative 3 will require the excavation of approximately 10 percent more material. The potential risk is the same for Alternatives 1 and 3.

14. Section 4.7.
CDM estimated the costs of each of the alternatives in an inconsistent manner. The goal of a feasibility study cost estimate is to evaluate costs of different alternatives on a comparative basis. Therefore, we suggest that the cost estimates be performed using an incremental approach in an effort to eliminate inconsistencies between estimates created by assigning different cost values for the same activity. As an example, the Site Owner has estimated the cost of the UST closure to be $68,4000, yet CDM has included $451,000 in Alternatives 1 and 3 for the same UST closure activity. By using the incremental approach, this sort of discrepancy will be eliminated. For cost comparison purposes, we have assumed that the costs to perform the following activities would be the same for each alternative:

- Conducting the long-term monitoring program
- Removal and disposal of courtyard soils
- Excavation and removal of the UST.

Therefore, the costs to perform these activities were not included in the incremental cost analysis. Odgen has prepared incremental cost estimates for each of the alternatives and they are included in Attachment 2. A comparative summary table is also included in the attachment.

ATTACHMENT 1

LNAPL RECOVERY CALCULATION

OGDEN

Job Name: Cottman Ave. PRP Group			
Job Number: 87053-0000			
Title: LNAPL Recovery - Area 1			
Computed by: IK	Checked by: PM		
Date: 06-15-00	Sheet:	Of:	

Objective: Determine the recoverable LNAPL from the Area-1 excavation area for theMetal Bank Remediation Project.

Method: American Petroleum Institution. Vol. 4682. June 1999. Pages 3.11, 3.17, 3.33, 5.26-5.27

Assume: LNAPL density = .882 g/cm^3 (Electrical Insulating Oil)
Hydraulic Conductivity (K_w) = 1 x 10^{-3} cm/s
Loamy Sand texture

Recoverable Free-Product Volume Equation:

$$V_0 = A_{lens}((\beta-\gamma)b_0 - \alpha\beta)$$

A_{lens} = Area of LNAPL layer = 5528 ft^2 = 514 m^2
b_0 = Thickness of LNAPL layer = (.5)(observed thickness)
= (.5)(1/8")
= (.5)(.003175m) = .001190625m

α(m), β(slope), and γ are model parameters

From Table 3.5.2

α = .21m
β = .332
γ = .0746

V_0 = (514 m^2) x ((.332-.0746) x (.001190625m)-.21m x .332) = < 0 m^3

Thus, there will be no recoverable product from Area 1

OGDEN

Job Name: Cottman Ave. PRP Group	
Job Number: 87053-0000	
Title: LNAPL Recovery - Area 2	
Computed by: IK	Checked by: PM
Date: 06-15-00	Sheet: Of:

__Objective__: Determine the recoverable LNAPL from the Area-2 excavation for theMetal Bank Remediation Project.

__Method__: American Petroleum Institution. Vol. 4682. June 1999. Pages 3.11, 3.17, 3.33, 5.26-5.27

Assume: LNAPL density = .882 g/cm^3 (Electrical Insulating Oil)
Hydraulic Conductivity (K_w) = 1 x 10^{-3} cm/s
Loamy Sand texture

Recoverable Free-Product Volume Equation:

$$V_0 = A_{lens}((\beta-\gamma)b_0 - \alpha\beta)$$

A_{lens} = Area of LNAPL layer = 2362 ft^2 = 220 m^2
b_0 = Thickness of LNAPL layer = (.5)(observed thickness)
= (.5)(1"- 1/8")
= (.5)(.0254m-.003175m) = .0111m

α(m), β(slope), and γ are model parameters

From Table 3.5.2
α = .21m
β = .332
γ = .0746

V_0 = (220 m^2) x ((.332-.0746) x (.0111m)-.21m x .332) = < 0 m^3

Thus, there will be no recoverable product from Area 2

OGDEN

Job Name: Cottman Ave. PRP Group	
Job Number: 87053-0000	
Title: LNAPL Recovery - Area 3	
Computed by: IK	Checked by: PM
Date: 06-15-00	Sheet: Of:

Objective: Determine the recoverable LNAPL from the Area-3 excavation for theMetal Bank Remediation Project.

Method: American Petroleum Institution. Vol. 4682. June 1999. Pages 3.11, 3.17, 3.33, 5.26-5.27

Assume: LNAPL density = .882 g/cm^3 (Eletrical Insulating Oil)
Hydraulic Conductivity (K_w) = 1 x 10^{-3} cm/s
Loamy Sand texture

Recoverable Free-Product Volume Equation:

$$V_0 = A_{lens}((\beta-\gamma)b_0 - \alpha\beta)$$

A_{lens} = Area of LNAPL layer = 244 ft^2 = 23 m^2
b_0 = Thickness of LNAPL layer = (.5)(observed thickness)
= (.5)(5.75" - 1")
= (.5)(.14605m-.0254m) = .060325m

α(m), β(slope), and γ are model parameters

From Table 3.5.2

α = .21m
β = .332
γ = .0746

V_0 = (23 m^2) x ((.332-.0746) x (.06325m)-.21m x .332) = < 0 m^3

Thus, there will be no recoverable product from Area 3

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ATTACHMENT 2

COST ESTIMATES FOR ALTERNATIVES

Metal Bank Superfund Site
Focused Feasibility Study
Cost Estimate Summary Table

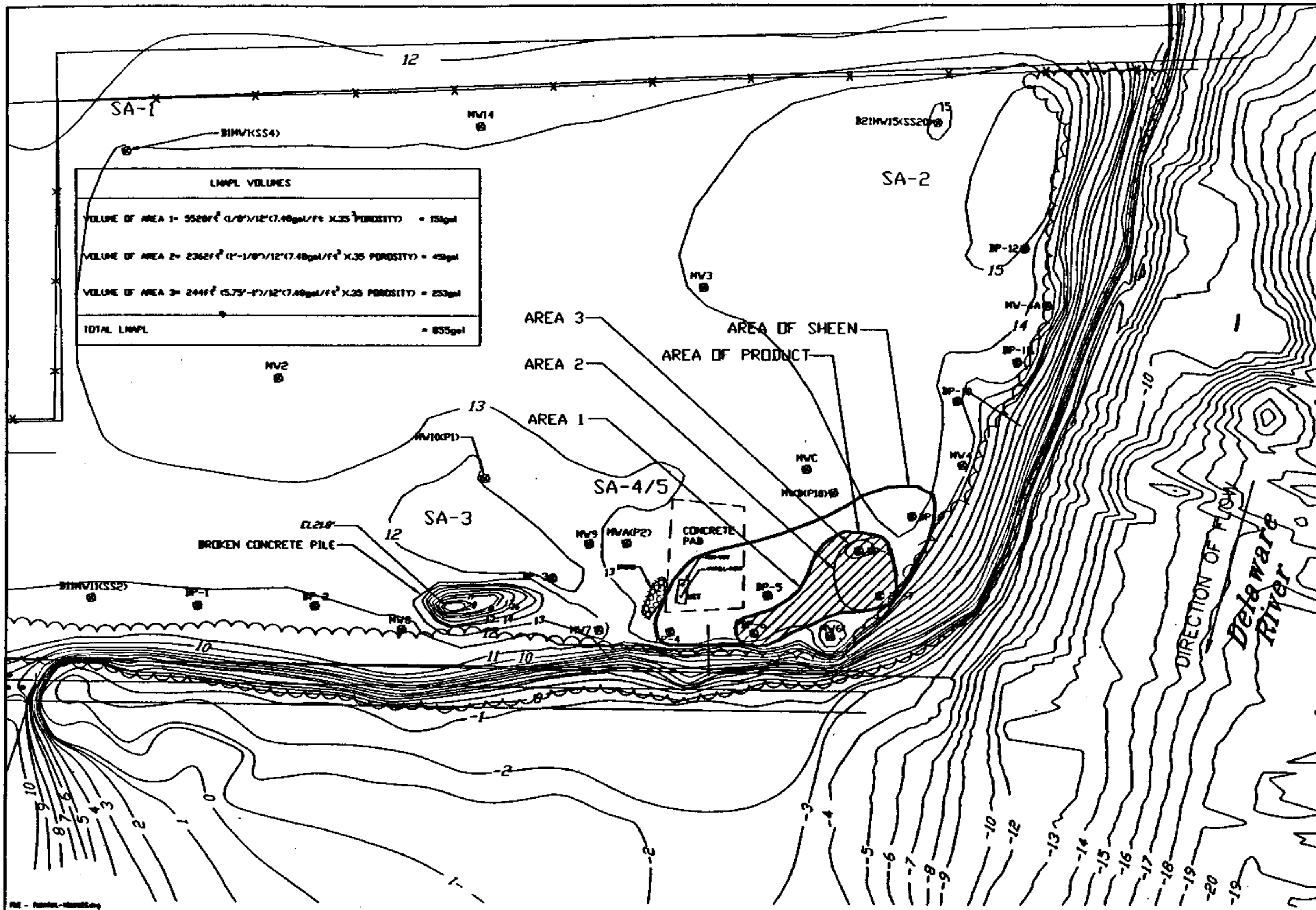
ALTERNATIVE	PRESENT WORTH TOTAL COSTS
PRP Group LNAPL Excavation Alternative	$4,516,716
ROD Remedy with Modified Sheet Pile Wall	$4,962,811
ROD Remedy	$6,486,561
Site Owner's Alternative	$4,233,188

Metal Bank Superfund Site
Focused Feasibility Study
Site Owner Alternative - Cost Estimate

Item No.	Component	Quantity	Unit	Unit Cost	Cost	Capital Costs	O & M Cost (Annual)	O & M Cost (Total)
H	**LNAPL Collection System**					$2,586,550		$0.00
	Sheet Pile Wall Installation	1,200	LF	$1,375	$1,650,000			
	Trench with Shoring Box (1200' x 5' x 15' Depth)	3,400	CY	$30	$102,000			
	HDPE	13,800	SF	$5	$69,000			
	Dispose Rubble	780	Tons	$20	$15,600			
	Soil Transport and Disposal PA Landfill	2,200	Tons	$50	$110,000			
	Soil Transport and Disposal TSCA Landfill	2,200	Tons	$158	$347,600			
	Collection Pipe and Installation 15-foot-depth	1,200	FT	$40	$48,000			
	Precast Concrete Manholes (5' Diam x 15' Depth)	6	EA	$3,500	$21,000			
	Oil Skimmers	6	EA	$12,000	$72,000			
	Water Well Passages	6	EA	$10,000	$60,000			
	Activated Carbon	6	EA	$2,000	$12,000			
	Backfill Trench (Pea Gravel)	3,750	Tons	$17	$63,750			
	Backfill Trench (General Fill)	1,200	Tons	$13	$15,600			
	Operation and Maintenance of System	1	LS					1000000
I	**All Upland Excavation and Offsite Disposal of Soil**					$0		
	Mob/Demob	0	EA	$ 16,830	$ -			
	Dewater/Treat	0	LS	$ 250,000	$ -			
	Excavate/Stockpile Loadout	0	CY	$10	$0			
	Dispose Rubble	0	Tons	$20	$0			
	Soil Transport and Disposal PA Landfill	0	Tons	$50	$0			
	Soil Transport and Disposal TSCA Landfill	0	Tons	$158	$0			
	Backfill	0	Tons	$ 13	$ -			
					Subtotals	$2,586,550	$0	$1,000,000
					+ 10% Engineering	$ 258,655		
					+ 15% Contingency	$ 387,983		
					Total Capital Cost	$ 3,233,188		
					Present Worth of Total O&M Cost	$1,000,000		
					Total Present Worth	$ 4,233,188		

Notes: Trench is 1200 feet long by 5 feet wide (based on excavation through debris) by 15 feet deep to penetrate groundwater table by 3 feet and will require a double trench box.
Pipe Installation will require personnel entry in a 15-foot-deep trench while dewatering.
Design assumes 1200 feet of trenching will be adequate to collect all LNAPL and 6 sets of pumps and manholes will be installed over 1200 feet.
Backfill Trench assumes pea gravel will be required to provide permeable collection media.
Assumes sheet pile wall will be 55 feet deep at a cost of $25/ft2 or $1,375 per linear foot.

DRAWINGS



LNAPL VOLUMES	
VOLUME OF AREA 1= 5520ft² (1/8")/12"(7.48gal/ft³ X.35 POROSITY)	= 151gal
VOLUME OF AREA 2= 2362ft² (1"-1/8")/12"(7.48gal/ft³ X.35 POROSITY)	= 451gal
VOLUME OF AREA 3= 244ft² (5.75"-1")/12"(7.48gal/ft³ X.35 POROSITY)	= 253gal
TOTAL LNAPL	= 855gal

LEGEND

- APPROXIMATE TREE LINE
- FENCE
- PROPERTY BOUNDARY
- INTERMEDIATE CONTOUR 1 FOOT INTERVAL
- INDEX CONTOUR 5 FOOT INTERVAL
- BP-1 PIEZOMETER
- MW4 MONITORING WELL

NOTES:

1. POROSITY BASED ON GEOTECHNICAL RESULTS AND POROSITY VALUES FROM TABLE 4-2 OF C.W. FETTER "APPLIED HYDROLOGY," 2nd EDITION, 1988
2. NO VOLUME WAS CALCULATED FOR THE SHEEN AS IT WAS NOT A MEASURABLE OR CALCULABLE THICKNESS

TRUE NORTH

1"=80'

0 40 80 160

SCALE IN FEET

ENVIRONMENTAL AND ENERGY SERVICES CO., INC.

HARTCROWSER

COTTMAN AVENUE PRP GROUP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

1650 ARCH STREET

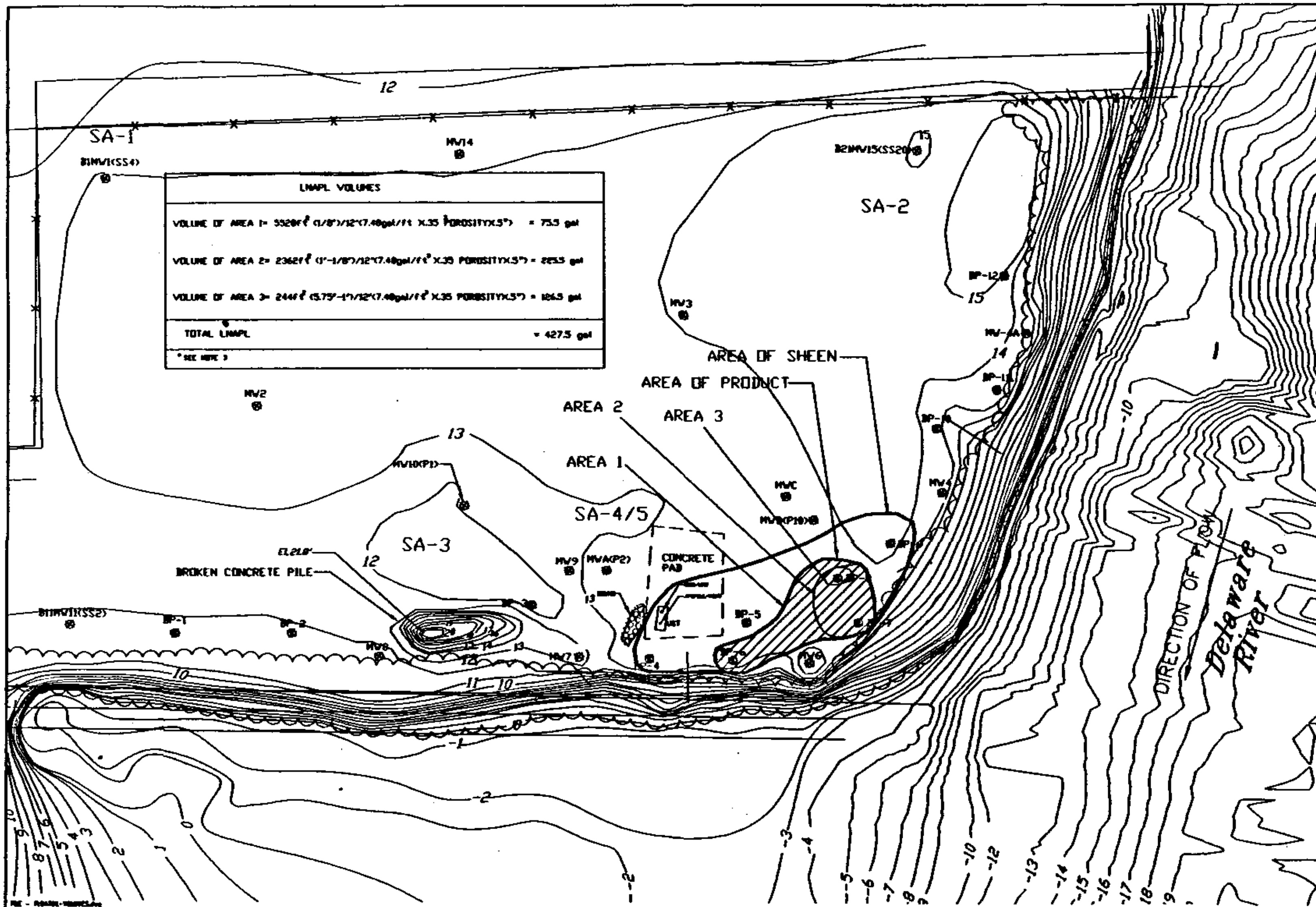
PHILADELPHIA, PENNSYLVANIA

INTERMEDIATE DESIGN REPORT

FLOATABLE OIL/LNAPL APPARENT VOLUME CALCULATION

SCALE AS SHOWN

AR001615



LNAPL VOLUMES	
VOLUME OF AREA 1= 5520ft² (1/8")/12"(7.48gal/ft X.35 *POROSITY(X.5")	= 75.5 gal
VOLUME OF AREA 2= 2362ft² (1"-1/8")/12"(7.48gal/ft² X.35 POROSITY(X.5")	= 225.5 gal
VOLUME OF AREA 3= 244ft² (5.75"-1")/12"(7.48gal/ft² X.35 POROSITY(X.5")	= 126.5 gal
TOTAL LNAPL	= 427.5 gal
* SEE NOTE 3	

LEGEND

APPROXIMATE TREE LINE

FENCE

PROPERTY BOUNDARY

INTERMEDIATE CONTOUR 1 FOOT INTERVAL

INDEX CONTOUR 5 FOOT INTERVAL

BP-1 PIEZOMETER

MW4 MONITORING WELL

NOTES:

1. POROSITY BASED ON GEOTECHNICAL RESULTS AND POROSITY VALUES FROM TABLE 4-2 OF C.W. FETTER "APPLIED HYDROLOGY," 2nd EDITION, 1988
2. NO VOLUME WAS CALCULATED FOR THE SHEEN AS IT WAS NOT A MEASURABLE OR CALCULABLE
3. FACTOR OF 0.5 BASED ON MERCER, J.W., AND R.M. COHEN, 1990. A REVIEW OF IMMISCIBLE FLUIDS IN THE SUBSURFACE: PROPERTIES, MODELS, CHARACTERIZATION, AND REMEDIATION, J. CONTAM. HYDROL., 6: 107 - 163. "... LNAPL WELL THICKNESS EXCEEDS SATURATED FORMATION THICKNESS BY A FACTOR OF APPROX. 2-10 ..."

TRUE NORTH

1"=80'

0 40 80 160

SCALE IN FEET

ENVIRONMENTAL AND ENERGY SERVICES CO., INC.

HARTCROWSER

COTTMAN AVENUE PRP GROUP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

1650 ARCH STREET

PHILADELPHIA, PENNSYLVANIA

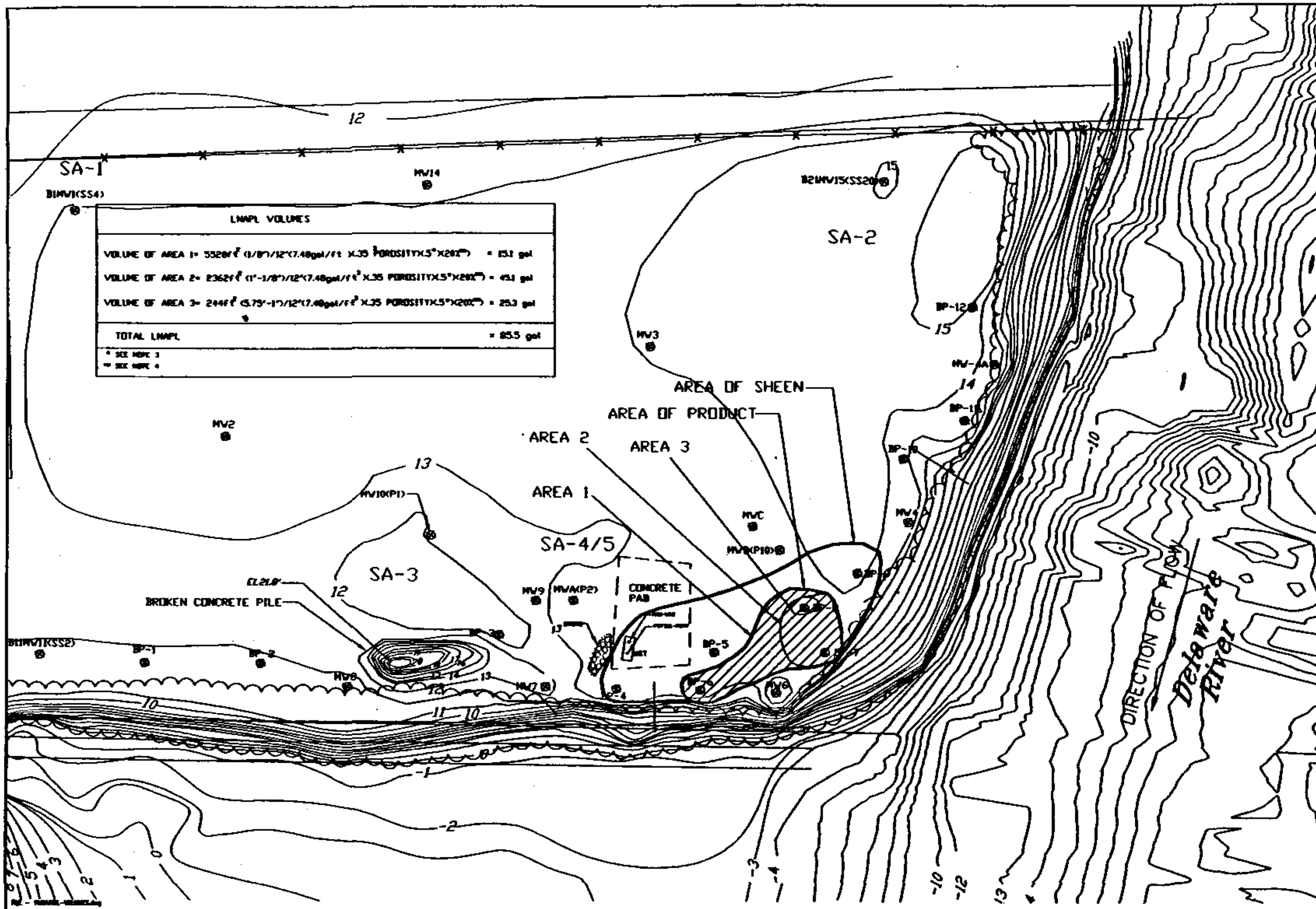
INTERMEDIATE DESIGN REPORT

FLOATABLE OIL/LNAPL ACTUAL VOLUME CALCULATION

SCALE AS SHOWN

SHEET 2 OF 3

AR001616



LEGEND

- APPROXIMATE TREE LINE
- FENCE
- PROPERTY BOUNDARY
- INTERMEDIATE CONTOUR 1 FOOT INTERVAL
- INDEX CONTOUR 5 FOOT INTERVAL
- BP-1 PIEZOMETER
- MW4 MONITORING WELL

NOTES:

1. POROSITY BASED ON GEOTECHNICAL RESULTS AND POROSITY VALUES FROM TABLE 4-2 OF C.W. FETTER "APPLIED HYDROLOGY," 2nd EDITION, 1988
2. NO VOLUME WAS CALCULATED FOR THE SHEEN AS IT WAS NOT A MEASURABLE OR CALCULABLE
3. FACTOR OF 0.5 BASED ON MERCER, J.W., AND R.M. COHEN, 1990. A REVIEW OF IMMISCIBLE FLUIDS IN THE SUBSURFACE: PROPERTIES, MODELS, CHARACTERIZATION, AND REMEDIATION. J. CONTAM. HYDROL., 6: 107 - 163. "... LNAPL WELL THICKNESS EXCEEDS SATURATED FORMATION THICKNESS BY A FACTOR OF APPROX. 2-10 ..."
4. 20% OF LNAPL VOLUME IS ASSUMED AS RECOVERABLE BASED ON: FREE PRODUCT RECOVERY OF PETROLEUM HYDROCARBON LIQUIDS API 4682, JUNE 1999

TRUE NORTH

1"=80'

0 40 80 160

SCALE IN FEET

COTTMAN AVENUE PRP GROUP

INTERMEDIATE DESIGN REPORT

RECOVERABLE OIL/LNAPL VOLUME CALCULATOR

HARTCROWSER

AR001617

Metal Bank Superfund Site
Focused Feasibility Study
ROD Remedy (Optimized Wall) - Cost Estimate

Item No.	Component	Quantity	Unit	Unit Cost	Cost	Capital Costs	O & M Cost (Annual)	O & M Cost (Total)
H	**LNAPL Collection System**					$1,276,050		$379,600.00
	Sheet Pile Wall Installation	660	LF	$1,375	$907,500			
	LNAPL Trench with Shoring Box (400' x 5' x 15' Depth)	1,100	CY	$30	$33,000			
	Dispose Rubble	250	Tons	$20	$5,000			
	Soil Transport and Disposal PA Landfill	700	Tons	$50	$35,000			
	Soil Transport and Disposal TSCA Landfill	700	Tons	$158	$110,600			
	Collection Pipe and Installation 15-foot depth	400	FT	$40	$16,000			
	Precast Concrete Manholes (5' Diam x 15' Depth)	5	EA	$3,500	$17,500			
	Backfill Trench (Pea Gravel)	1,250	Tons	$17	$21,250			
	Backfill Trench (General Fill)	400	Tons	$13	$5,200			
	Operation and Maintenance of System	1	LS	$125,000	$125,000			
	Operation and Maintenance of System	1	Year				$52,000.00	
I	**All Upland Excavation and Offsite Disposal of Soil**					$2,390,519		
	Mob/Demob	1	EA	$ 16,830	$ 16,830			
	Concrete Stockpile Area (200 x 80 ft)	16,000	FT2	$ 5	$ 80,000			
	Pre-cast Barriers (520 ft)	520	FT	$ 65	$ 33,800			
	Misc Curbs, Vaults, Piping	1	LS	$ 25,000	$ 25,000			
	Dewater/Treat	1	LS	$ 250,000	$ 250,000			
	Excavate/Stockpile Loadout	11,914	CY	$10	$119,141			
	Dispose Rubble	2,681	Tons	$20	$53,613			
	Soil Transport and Disposal PA Landfill	7,595	Tons	$50	$379,762			
	Soil Transport and Disposal TSCA Landfill	7,595	Tons	$158	$1,200,048			
	Backfill	17,871	Tons	$ 13	$ 232,325			
					Subtotals	$3,666,569	$52,000	$379,600
				+ 10% Engineering		$ 366,657		
				+ 15% Contingency		$ 549,985		
				Total Capital Cost		$ 4,583,211		
				Present Worth of Total O&M Cost		$379,600		
				Total Present Worth		$ 4,962,811		

Notes: Trench is 400 feet long by 5 feet wide (based on excavation through debris) by 15 feet deep to penetrate groundwater table by 3 feet and will require a double trench box.
Dewatering System During Construction is the same for PRP and ROD alternatives.
Rubble Disposal includes screening and backfilling 15 percent of excavated material.
Excavation Quantity includes a 10% contingency.
Soil disposal assumes remaining excavated soil will be disposed off site with 50 percent going to each of TSCA and State Landfills for PRP and ROD alternatives.
Pipe Installation will require personnel entry in a 15-foot-deep trench while dewatering.
Design assumes 400 feet of trenching will be adequate to collect all LNAPL and 5 sets of pumps and manholes will be installed over 400 feet.
Backfill Trench assumes pea gravel will be required to provide permeable collection media.
Oil Collection Equipment includes pumps, piping, electrical power and control, collection tanks, heated control building large enough to contain equipment and tanks.
O&M includes 52 weeks with three visits per week at 4 hours times $60 per hour, plus $15,000.00 for liquid disposal and miscellaneous maintence/repair costs.
Assumes sheet pile wall will be 55 feet deep at a cost of $25/ft2 or $1,375 per linear foot.

Metal Bank Superfund Site
Focused Feasibility Study
PRP Group Alternative - Cost Estimate

Item No.	Component	Quantity	Unit	Unit Cost	Cost	Capital Costs	O & M Cost (Annual)	O & M Cost (Total)
H	**Additional Excavation to Remove LNAPL**					$1,222,854		$0.00
	Sheet Pile Wall Installation	660	LF	$1,375	$907,500			
	Excavation to Remove LNAPL	1,690	CY	$30	$50,700			
	Dispose Rubble	380	Tons	$20	$7,605			
	Soil Transport and Disposal PA Landfill	1,077	Tons	$50	$53,869			
	Soil Transport and Disposal TSCA Landfill	1,077	Tons	$158	$170,225			
	Backfill Trench	2,535	Tons	$13	$32,955			
I	**All Upland Excavation and Offsite Disposal of Soil**					$2,390,519		
	Mob/Demob	1	ea	$ 16,830	$ 16,830			
	Concrete Stockpile Area (200 x 80 ft)	16,000	FT2	$ 5	$ 80,000			
	Pre-cast Barriers (520 ft)	520	FT	$ 65	$ 33,800			
	Misc Curbs, Vaults, Piping	1	LS	$ 25,000	$ 25,000			
	Dewater/Treat	1	LS	$ 250,000	$ 250,000			
	Excavate/Stockpile Loadout	11,914	CY	$10	$119,141			
	Dispose Rubble	2,681	Tons	$20	$53,613			
	Soil Transport and Disposal PA Landfill	7,595	Tons	$50	$379,762			
	Soil Transport and Disposal TSCA Landfill	7,595	Tons	$158	$1,200,048			
	Backfill	17,871	Tons	$ 13	$ 232,325			

Subtotals		$3,613,373	$0	$0
+ 10% Engineering	$	361,337		
+ 15% Contingency	$	542,006		
Total Capital Cost		$4,516,716.33		
Present Worth of Total O&M Cost		$0		
Total Present Worth	$	4,516,716		

Notes: Excavation volume is based on AutoCAD calculation provided.
Excavation quantities include a 10% contingency.
Dewatering System During Construction is the same for PRP and ROD alternatives.
Rubble Disposal includes screening and backfilling 15 percent of excavated material.
Soil disposal assumes remaining excavated soil will be disposed off site with 50 percent going to each of TSCA and State Landfills for PRP and ROD alternatives.
Backfill assumes general fill.
LNAPL removal assumes standard O&M inspections will be adequate.
Assumes sheet pile wall will be 55 feet deep at a cost of $25/ft2 or $1,375 per linear foot.

Metal Bank Superfund Site
Focused Feasibility Study
ROD Remedy - Cost Estimate

Item No.	Component	Quantity	Unit	Unit Cost	Cost	Capital Costs	O & M Cost (Annual)	O & M Cost (Total)
H	**LNAPL Collection System**					$2,495,050		$379,600.00
	Sheet Pile Wall Installation	1,200	LF	$1,375	$1,650,000			
	Trench with Shoring Box (1200' x 5' x 15' Depth)	3,400	CY	$30	$102,000			
	Dispose Rubble	780	Tons	$20	$15,600			
	Soil Transport and Disposal PA Landfill	2,200	Tons	$50	$110,000			
	Soil Transport and Disposal TSCA Landfill	2,200	Tons	$158	$347,600			
	Collection Pipe and Installation 15-foot-depth	1,200	FT	$40	$48,000			
	Precast Concrete Manholes (5' Diam x 15' Depth)	5	EA	$3,500	$17,500			
	Backfill Trench (Pea Gravel)	3,750	Tons	$17	$63,750			
	Backfill Trench (General Fill)	1,200	Tons	$13	$15,600			
	Operation and Maintenance of System	1	LS	$125,000	$125,000			
	Operation and Maintenance of System	1	Year				$52,000.00	
I	**All Upland Excavation and Offsite Disposal of Soil**					$2,390,519		
	Mob/Demob	1	EA	$ 16,830	$ 16,830			
	Concrete Stockpile Area (200 x 80 ft)	16,000	FT2	$ 5	$ 80,000			
	Pre-cast Barriers (520 ft)	520	FT	$ 65	$ 33,800			
	Misc Curbs	1	LS	$ 25,000	$ 25,000			
	Dewater/Treat	1	LS	$ 250,000	$ 250,000			
	Excavate/Stockpile Loadout	11,914	CY	$10	$119,141			
	Dispose Rubble	2,681	Tons	$20	$53,613			
	Soil Transport and Disposal PA Landfill	7,595	Tons	$50	$379,762			
	Soil Transport and Disposal TSCA Landfill	7,595	Tons	$158	$1,200,048			
	Backfill	17,871	Tons	$ 13	$ 232,325			
					Subtotals	$4,885,569	$52,000	$379,600
				+ 10% Engineering		$ 488,557		
				+ 15% Contingency		$ 732,835		
				Total Capital Cost		$ 6,106,961		
				Present Worth of Total O&M Cost		$379,600		
				Total Present Worth		$ 6,486,561		

Notes: Trench is 1200 feet long by 5 feet wide (based on excavation through debris) by 15 feet deep to penetrate groundwater table by 3 feet and will require a double trench box.
Dewatering System During Construction is the same for PRP and ROD alternatives.
Rubble Disposal includes screening and backfilling 15 percent of excavated material.
Excavation Quantity includes a 10% contingency.
Soil disposal assumes remaining excavated soil will be disposed off site with 50 percent going to each of TSCA and State Landfills for PRP and ROD alternatives.
Pipe Installation will require personnel entry in a 15-foot-deep trench while dewatering.
Design assumes 400 feet of trenching will be adequate to collect all LNAPL and 5 sets of pumps and manholes will be installed over 400 feet.
Backfill Trench assumes pea gravel will be required to provide permeable collection media.
Oil Collection Equipment includes pumps, piping, electrical power and control, collection tanks, heated control building large enough to contain equipment and tanks.
O&M includes 52 weeks with three visits per week at 4 hours times $60 per hour plus $15,000.00 for liquid disposal and miscellaneous maintence/repair costs.
Assumes sheet pile wall will be 55 feet deep at a cost of $25/ft2 or $1,375 per linear foot.